

DETAILED ACTION

Oath/Declaration

The oath or declaration is not submitted. An oath or declaration in compliance with 37 CFR 1.67(a) identifying this application by application number and filing date is required. See MPEP §§ 602.01 and 602.02.

Drawings

The drawings are objected to as failing to comply with 37 CFR 1.84(p) (4) because reference character "31" has been used to designate both igniter and one end (page 8). Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

The drawings are objected to because Fig 19D is missing. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if

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only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

Applicant is reminded of the proper content of an abstract of the disclosure.

A patent abstract is a concise statement of the technical disclosure of the patent and should include that which is new in the art to which the invention pertains. If the patent is of a basic nature, the entire technical disclosure may be new in the art, and the abstract should be directed to the entire disclosure. If the patent is in the nature of an improvement in an old apparatus, process, product, or composition, the abstract should include the technical disclosure of the improvement. In certain patents, particularly those for compounds and compositions, wherein the process for making and/or the use thereof are not obvious, the abstract should set forth a process for making and/or use

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thereof. If the new technical disclosure involves modifications or alternatives, the abstract should mention by way of example the preferred modification or alternative.

The abstract should not refer to purported merits or speculative applications of the invention and should not compare the invention with the prior art.

Where applicable, the abstract should include the following:

- (1) if a machine or apparatus, its organization and operation;
- (2) if an article, its method of making;
- (3) if a chemical compound, its identity and use;
- (4) if a mixture, its ingredients;
- (5) if a process, the steps.

Extensive mechanical and design details of apparatus should not be given.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. Claims 79, 80, 86, 88, 90, 92, 93, 98, 99, 105 and 106 rejected under 35 U.S.C. 102(b) as being anticipated by Kesseli et al 5,450,724. Kesseli teaches the invention as claimed (see figs 1-4), a mixing apparatus for mixing fuel and air for combustion in a gas turbine, the mixing apparatus comprising: a body 50 (fig 3) having a mixing channel 61 for mixing fuel and air for combustion, the mixing channel having a

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main channel portion (closer to 69) and a distinct insert channel portion (closer to 67), a fuel inlet 63a being located on the insert channel portion (see fig 4A); (claim 80) wherein the fuel inlet is located in a portion of the insert channel portion having a curved cross section (see fig 4A); (claim 88) wherein the inlet section 67 has a plurality of fuel inlets 66 (in fig 4) spaced around a periphery thereof; (claim 90) wherein, the body includes a plurality of said mixing channels 61, the mixing channels being regularly spaced about a dominant axis of the body (fig 3); (claim 92 and 93) including a plurality of primary 63 and secondary 74 fuel inlet; (claim 98) wherein the body has a back plate 55 and each mixing channel is formed in a portion of the body upstanding from the back plate on a fuel side thereof; (claim 99) wherein the secondary fuel inlets are adapted to admit fuel at a location outside the mixing channel part (column 3 lines 67-68, column 4 lines 1-2). Kesseli also teaches (claims 105 and 106) a combustor for burning fuel and air in a gas turbine engine, the combustor incorporating the mixing apparatus discussed above (see fig 2); wherein the combustor has a cylindrical outer casing wall 32 with an end plate 55, the mixing apparatus being located centrally on the end plate (fig 2).

2. Claims 102, 79, 86 and 103 are rejected under 35 U.S.C. 102(b) as being anticipated by Norster et al 6,532,726. Norster teaches the invention as claimed (see figs 1-4), a swirler 12 for mixing air and fuel for combustion, the swirler comprising, a body having a series of mixing channels 14, the mixing channels having a bell-mouthed entrance (expanding near 23), the mixing channels being generally co-planar with one another and radially inwardly angled in order to induce swirl (see fig 4); the swirler

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further including a back plate 16 (fig 1) adjacent the mixing channels, the mixing channel having partly curved cross section (near 23).

3. Claim 111 rejected is under 35 U.S.C. 102(b) as being anticipated by Ryberg et al 3,691,762. Ryberg teaches the invention as claimed, a swirler for mixing fuel and air for combusting, the swirler comprising, a body 8 having at least one mixing channel 134 (see fig 4), wherein the mixing channel leads to a toroidal chamber 61 (column 4 line 1).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
 2. Ascertaining the differences between the prior art and the claims at issue.
 3. Resolving the level of ordinary skill in the pertinent art.
 4. Considering objective evidence present in the application indicating obviousness or nonobviousness.
4. Claims 94-97, 101, 109, 110 112 and 100 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kesseli et al in view of Ryberg et al. Kesseli teaches the invention as claimed and as discussed above.

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However, Kesseli does not teach a mixing apparatus (claim 94) wherein, the secondary fuel inlets have a shield for providing shielded pilot fuel injection; (claim 95) wherein, a configuration of the shield conforms to an outflow direction of a mixing channel; (claim 96), wherein, the shield comprises a circular plate for providing shielded flow in a radially inward direction from under the side plate; (claim 97) wherein, the plate includes at least one hole therethrough enabling pilot fuel to flow in an axial direction through said plate; (claim 100 and 101) wherein, the secondary fuel inlets are adapted to admit fuel into a zone of separated flow on the body; the secondary fuel inlet being configured for direct injection of pilot fuel; (claim 109) wherein, one or more secondary fuel inlets are provided shielded by an annular ring coaxial with a central axis of the apparatus, discharging pilot fuel in a radially inward direction onto a back wall of the apparatus.

Ryberg discloses a mixing apparatus (claim 94) wherein, the secondary fuel inlet 30 has a shield (the piece at the end of 30 see fig 2) for providing shielded pilot fuel injection; (claim 95) wherein, a configuration of the shield conforms to an outflow direction of a mixing channel (space in front of 60); (claim 96), wherein, the shield comprises a plate for providing shielded flow in a radially inward direction from under the side plate (see fig 2); (claim 97) wherein, the plate includes at least one hole 108 therethrough enabling pilot fuel to flow in an axial direction through said plate; (claim 101) wherein, the secondary fuel inlet being configured for direct injection of pilot fuel (column 5 lines 15-25); (claim 109) wherein, one secondary fuel inlet is provided

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shielded by an annular ring coaxial discharging pilot fuel in a radially inward direction onto a back wall of the apparatus (see fig 2).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Kesseli's mixing apparatus by including all the limitations taught by Ryberg and recited above in order to provide fuel for the pilot in such a way that flame blow-off is minimized.

With regard to claim 100, Kesseli does not specifically disclose that the secondary fuel is admitted in the zone of flow separation in the body, however one of ordinary skill in the art would recognize that flow separation could occur as a result of high swirl flow at the inner wall through which the channels empty the mixture. This is the vicinity where the secondary fuel inlet discharged fuel (column 3 lines 67-68 and column 4 lines 1-2).

5. Claims 81 and 84 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kesseli in view of Thomas 2,214,568. Kesseli teaches the invention as claimed and as discussed above.

However, Kesseli does not teach a mixing apparatus wherein, the insert channel portion comprises a plug attached to one end of the main channel portion, the plug being removable from the body; wherein, the insert channel portion comprises a plug having several primary inlets spaced therearound.

Thomas discloses a fuel burner including an insert channel 41 wherein, the insert channel portion comprises a plug 38 attached to one end of the channel, the plug being

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removable from the body (page 2 line 4); wherein, the plug has primary fuel inlet 35 spaced there around.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Kesseli's mixing apparatus by including a plug as discussed above in order to provide a removable means of metering fuel into the mixer and thereby provide flexibility in changing the heat generation rate.

6. Claims 82 and 83 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kesseli in view of Adzhiam et al 6,244,040. Kesseli teaches the invention as claimed and as discussed above except for a pre-calibrated insert of the mixing channel; the mixing channel having a transition portion merging to an exit portion with a rectangular cross section. Kesseli also teaches the upstream portion of the mixing channel being tilted relative to the exit portion thereof (see fig 3).

Adzhiam et al discloses a mixer with insert having pre-calibrated openings (column 4 lines 48-49).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Kesseli's mixing apparatus by including a pre-calibrated insert in order to accurately meter the fuel inlet into the mixer.

With regard to the mixing channel having a transition portion merging to an exit portion with a rectangular cross section, this is deemed a design choice since the Applicant does not disclose any critically for this change in shape.

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7. Claim 85 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kesseli in view of Norster. Kesseli teaches the invention as claimed and as discussed above except for the mixing channel having a bell-mouth entrance.

Norster teaches a mixing apparatus wherein the mixing channel has a bell-mouth entrance (near 23 see fig 3).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Kesseli's mixing apparatus by including a bell-mouth channel entrance in order to accelerate the incoming flow and enhance mixing.

8. Claim 87 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kesseli in view of Prociw et al 6,289,677. Kesseli teaches the invention as claimed and as discussed above except for one portion of the channel having an elliptical cross section.

Prociw discloses in a fuel injector wherein the channel has an elliptical cross section 64 (in Fig 4A)

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Kesseli's mixing apparatus by including channels with elliptical cross section in order to minimize flow separation at the exit.

9. Claim 89 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kesseli in view of Corr et al 7,093,445. Kesseli teaches the invention as claimed and as discussed above except for channel aspect ratio being ≤ 2 .

Corr et al discloses a mixing apparatus wherein the channel aspect ratio is < 2 (column 16 line 56).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Kesseli's mixing apparatus by including channels with aspect ratio < 2 in order to obtain better mixing of fuel and air.

10. Claim 91 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kesseli in view of Bader 3,657,885. Kesseli teaches the invention as claimed and as discussed above except for each mixing channel comprising a bore formed in the body of the apparatus.

Bader discloses a mixing apparatus (fig 3) wherein each mixing channel comprises a bore 19 formed in the body of the apparatus.

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Kesseli's mixing apparatus by including channels comprising bores formed in the body of the apparatus in order to minimize the number of parts.

11. Claims 107 and 108 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kesseli in view of Malgieri 2,675,671. Kesseli teaches (see fig 3) providing a fuel/air mixing channel 61 having a fuel inlet device formed with a fuel inlet 63; and then installing the fuel inlet device on to the mixer (see figs 2-4). Kesseli does not specifically disclose method of calibrating the fuel inlet device; wherein, calibrating the fuel inlet device includes calibrating the device with respect to fuel flow characteristics thereof.

Malgieri discloses a method of calibrating fuel mixer in a gas turbine comprising calibrating the fuel inlet device; wherein, calibrating the fuel inlet device includes calibrating the device with respect to fuel flow discharge orifices (column 6 lines 23-27)

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Kesseli's mixing apparatus by including a method of calibrating the fuel mixer in order to accurately meter the fuel going into the mixer.

12. Claim 104 is rejected under 35 U.S.C. 103(a) as being unpatentable over Norster et al in view of Prociw et al. Norster teaches the invention as claimed and as discussed above except for each channel having an elliptical cross section.

Prociw discloses in a fuel injector wherein the channel has an elliptical cross section 64 (in Fig 4A)

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Norster's mixing apparatus by including channels with elliptical cross section in order to minimize flow separation at the exit.

13. Claims 110 and 112 are rejected under 35 U.S.C. 103(a) as being unpatentable over Norster in view of Ryberg. Norster teaches the invention as claimed and as discussed above.

However Norster does not specifically teach a swirler wherein, the mixing channel leads to a toroidal chamber, even though his mixing apparatus obviously

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produces a toroidal flow. He does not disclose a mixer, wherein the toroidal chamber has the same height as a height of the mixing channel.

Ryberg discloses a swirler (fig 4) wherein, the mixing channels lead to a toroidal chamber 61 (in fig 2).

It would have been obvious to one of ordinary skill in the art at the time of the invention to modify Norster's mixing apparatus by including the mixing channel that leads to a toroidal chamber in order to thoroughly mix the fuel and air.

With regard to claim 112, the toroidal chamber having the same height as the height of the mixing channel is deemed a design choice since the Applicant does not disclose any significance of making the toroidal chamber have the same height as the height of the mixing channel.

Conclusion

The prior art made of record in the attached USPTO 892 and not relied upon is considered pertinent to applicant's disclosure.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CHUKA C. NDUBIZU whose telephone number is (571)272-6531. The examiner can normally be reached on Monday - Friday 8.30 - 4.30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steve McAllister can be reached on 571-272-6785. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Chuka C Ndubizu/
Examiner, Art Unit 3749

20080403

/Steven B. McAllister/
Supervisory Patent Examiner, Art Unit 3749